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The Surgical Advantages of the Buried Animal Suture,

And its Adaptability to Special Purposes.

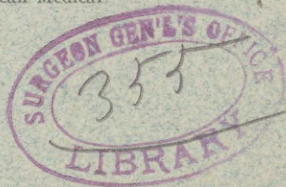
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THE SURGICAL ADVANTAGES OF THE BURIED ANIMAL SUTURE, AND ITS ADAPTABILITY TO SPE- CIAL PURPOSES.

In the light of modern science old experiences and theories are to be viewed in a new way, and many facts are subject to an interpretation quite other than originally given. This is especially true in surgery in reference to the rôle of the suture. The introduction of antiseptic wound treatment has modified the use of the ligature and suture to a degree which renders possible results hitherto never attained.

A review of the principles of suturing necessarily involves a brief consideration of the ligaturé. Its application to arrest hæmorrhage seems so natural that it may be accepted as probable that it has been used from the earliest times of the race; certainly it was known to Hippocrates. Although frequent mention is made of the ligature by the earliest writers, it was considered a bold innovation when Ambrose Paré advocated the tying of vessels in amputations, and we can now understand why these teachings were received with so much doubt and later came near being rejected altogether. Even within our own times, it was applied in wounds which generally became septic, while the method of searing which it supplanted, by the very means used to prevent hæmorrhage, prevented, in large measure, septic poisoning.



In our own student days, the classic rule was to leave one end of the ligature of all large vessels long and, no matter how a wound was closed or dressed, this was to extend from the coapted parts. If several, they were supposed to serve a valuable purpose for drainage, and were intended to cause a sloughing of the constricted tissues and come away with them at the end, often, of many days or weeks.

Had Sir Joseph Lister done for the profession and the world no other service, his name should be handed down the generations for his admirable researches upon the ligation of vessels in amputations and especially in continuity. Others had indeed preceded him in the use of animal ligatures with excellent results, but their true mission could not be observed, except in aseptic wounds. Having excluded the ferments, Mr. Lister demonstrated that repair quickly supervened in a normal way, that the ligature soon underwent cell infiltration and was not thrown off, as formerly supposed necessary, as a foreign body. When his pupil in 1870, I observed that he practiced tying arteries, cutting the ligature short and closing the wound. He published, as early as April, 1869, an article in the *Lancet*, from which I quote:

“Thus the dead but nutritious mass had served as a *mould* for the formation of new tissue, the growing elements of which had *replaced* the materials absorbed, so as to constitute a living solid of the same form. . . . The two pieces of catgut which had been tied around the vessel at the distal part had become, as it were, fused together into a single fleshy band, inseparably blended with the external coat of the artery. The knots were nowhere discernible, and the only indication of the end which had been left long, at the time of the operation, was the presence of a black speck

(the original material contained dark mineral impurities) here and there upon a delicate thread of cellular tissue in connection with the vessel. The cardiac ligature was in like manner continuous in structure with the arterial wall. The short ends had disappeared, but the massive knot was represented by a soft, smooth lump which appeared at first homogeneous except that it was speckled with dark particles as above referred to. On section, however, I discovered, in the interior of the mass and lying close to the wall of the artery, a small residual portion of the original knot, of comparatively firm consistence, and with the threefold twisted character of the cord plainly visible. It was quite distinct from the living tissue, so that it could be readily picked out from its bed with a pair of needles. Here almost all the original tissue had been removed, but it had served as a mould for the development of new tissue which had taken its place, and which retained the form of the mould in which it had grown."

He describes the microscopic appearances as follows: "A bit of the residue of the peritoneal thread having been teased out with needles, in a drop of water presented, like a fresh piece of peritoneum, the wavy bundles of parallel fibres characteristic of perfectly developed fibrous tissue. Adhering to the surface of the remnant of the ligature was some soft opaque material, readily washed off with water, consisting of corpuscles of different forms, most of them caudate, or fibro-plastic, but some spherical, though not resembling those of pus; and, here and there, fragments of the original peritoneal tissue, affected more or less with interstitial cell development. At a short distance from the remains of the old thread, the fleshy material which had been formed at its expense

proved to be a most beautiful example of fibro-plastic structure, the coarse fibres which mainly constituted it being composed of very large elongated cells, often containing several nuclei and presenting in their course branchings and thickenings of various forms. Here and there were some fibres more perfectly formed, and also cells of a more rudimentary character. Again, the band which had resulted from the organization of the two fine threads of catgut which, from the smallness of their bulk, had no doubt vanished early, having had longer time to perfect its structure, was a comparatively well developed form of fibrous tissue, consisting of coarse fibres rather than of elongated cells, being thus intermediate between the merely fibro-plastic material of more recent growth and the completed texture of the original thread."

These demonstrations were early verified by a number of competent observers, and yet, so far as I know, so strong was the influence of previous prejudices, methods, and teachings, that the rational deductions from such valuable investigations and experiments were not broadened and applied to sutures until, in my own experience, the result of an accident in 1871. In the case of a strangulated hernia, where the opening was very large, Dr. A. P. Clarke, of Cambridge, and I refreshed the ring and sewed it with catgut, in order to prevent the descent of omentum or intestine, because of cough a produced by a severe bronchitis from which the patient was suffering at time of injury. We had no thought of cure. This, however, followed without any complication, and the patient remained without recurrence until her death, which occurred six years later.

A thoughtful observer could not help profiting from such an experience. I reviewed the interest-

ing studies and observations of Mr. Lister, instituted a careful series of experiments on animals, and later accidentally had the satisfaction of verifying the same, histologically, on the human subject. Upon these facts and deductions as fundamental, I established the operation for the cure of hernia by aseptic suturing of the refreshed parts in open wounds, and published the same in 1871,¹ republishing with additional results in 1878 and 1881;² the priority of which, I believe, is not questioned by any, and this is the method now adopted by most operators in all countries.

The dissection is made as freely as required to secure intelligent operating. The sac, if at all large, is drawn down and its base sewed evenly across by a continuous double animal suture by a method which I devised years since and described as the shoemaker's stitch. This is easily effected by using a needle with the eye near the point, which is the only essential in the needle, although usually, for convenience, a long needle more or less curved is fixed in a handle. The needle, threaded, is introduced, unthreaded, threaded with the other end of the suture and then withdrawn, thus carrying with it through a single puncture the suture. In this way a stitch is made as a cobbler applies his thread from opposite ends through the same hole, and this is continued until the seam is complete, having only a single knot at the last stitch. The sac, if small, is returned thus sutured, if large, is cut off. Then, in a similar way, often using a needle of considerable curve, the refreshed structures of the ring are sewed together and, where there is sufficient tissue, a superficial

¹ Boston Med. and Surg. Journal, November, 1871, p. 315.

² Transactions of American Med. Assoc., 1878; Transactions of International Medical Congress, 1881.

layer is closed in the same manner, over this, and finally the skin. As I shall have occasion to show later, the skin also is advantageously coapted by a buried suture.

From this as a beginning, little by little, I have extended the application of buried suturing until I have treated wounds in nearly every part of the body by this method. First, very naturally, came the amputation of the breast and the coaptation of the deep structures. Here the stitch, as above described, admirably takes the place of the button suture, still generally used in heavy, thick flaps. It further serves as a hæmostatic in the careful coaptation of the parts and, by lessening the exudation, renders the use of drainage often unnecessary. Generally, even in large wounds, I do not use drainage, relying, in an *aseptic* wound, upon the easy absorption of any slight effusion. Of course, in such coaptation, where fixation and rest are required for only a brief space, a small aseptic animal suture is quite sufficient, and may be applied by any needle in varying stitch. However, I quite prefer the double suture as above described, because of the accuracy of adjustment and evenness of strain on the parts involved. In 1881, I first applied this method of suturing to the stump of the uterus in hysterectomy, and thereby was enabled to demonstrate the intraperitoneal treatment of the stump without danger of sloughing or hæmorrhage. About the same time, I commenced the sewing of the pedicle in ovarian cystoma in similar way, and in both operations closed all free surfaces by a continuous glover suture taken through the peritoneum only. This was reported at the International Congress in London in 1881, and has since been ascribed to German authorities, but, so far as I have been able to learn, this is the first reference made to the subject.

The buried suture is one of the chief factors in my method of the restoration of the perineum. Believing that portion of the levator ani anterior to the anus, called the transversalis perinei, the part chiefly injured, which renders possible all the subsequent pathological changes in the vagina and uterus, I dissect the posterior portion of the vaginal attachment from the vulvar tissues and lift this forward, thus rendering it quite easy, with finger in rectum, to introduce deeply a curved needle. The tendon from the kangaroo, used in double stitch as before described, is preferred. In this way, as in no other, can the retracted ends of the transversali be brought together. Then the external wound is closed in continuous suture, and a double pin is often found useful to hold at rest, as in a splint, the parts without strain.

The abdominal wall in laparotomies for any cause is closed as in hernia, which is only a modified laparotomy; the peritoneum is first sewed and then the remainder of the wound is closed under irrigation. Since adopting this method the resulting cicatrix has been firm and unyielding. I have several times thus operated upon large umbilical hernias with perfect cure. I have used a buried suture with seeming advantage in resection of the pylorus, in one case, and in several cases of intestinal obstruction already reported.

Operations upon the rectum are little improved by any of our modern methods. In hemorrhoids it is true, the clamp and the use of the thermo-cautery are a great advance upon the older methods of ligature, and yet, only recently, in New York, was I shown by one of our best surgeons, an instrument by which the ligature might be more tightly applied and which he thought was better than the cautery. Both are certainly objectionable and the injection methods were gladly welcomed as improvements.

These are in turn faulty, since often the tissues, which are important to remain uninjured, are destroyed and the parts to be retained are unaffected. Some years since I operated upon two cases of prolapse by the double suture as described, the results were excellent. More recently I have, in a number of cases, operated in ordinary hemorrhoid in the following manner:

After stretching the sphincter, with the fingers in the bowel, carefully cut through the skin at the junction of mucous membrane to the subjacent connective tissue, this, with a little care, can be done usually almost without loss of blood. In a somewhat similar way divide the mucous coat above the ectatic vessels. Sew with double continuous stitch, if need be, completely around the bowel and then cut away the mass. With a finer suture join the cut edges over the enclosed first line of suturing (the seam), and thus nicely coapt the parts. Iodoform in the rectum and a careful dusting from time to time lessens the danger of infection, and, if kept aseptic for a few hours only, renders, by cell infiltration, the wound soon free from danger of septic absorption. It is in reality a plastic operation and should be done with all the care of an operation on the face. The pain resulting from the operation is certainly far less than by other methods. The cure is effected in less time and the result is better than I obtained by other procedures. It is simple and easy to do and I commend it confidently to the profession. In varicocèles I tie the veins and seal with iodoform collodion.

The time and thought which many of us have spent upon devising surgical dressings to render the atmospheric contagion innocuous to wounds can hardly be estimated. All of this study and experience has been doubtless profitable and some

of its fruitage yet valuable. However, given an aseptic wound, it is easy to retain it so, where drainage is not required, by sealing it with iodoform collodion. Thus treated, so far as prevention from infection is concerned, it matters little what external dressing is used. A number of days later the collodion scale can be separated from the skin, yet holding with it the upper border of each stitch, if taken in the ordinary way. These are separated at the line of the true skin, where the actively proliferating cells have infiltrated the suture and caused its absorption.

It somewhat recently occurred to me that this might be avoided and a gain made in safety and rapidity of repair, by burying even the sutures which coapt the skin. This is easily effected by using a blind stitch, generally best made with a straight needle, lightly but accurately including the connective tissue just beneath the skin from side to side. In this way the cut edges of the skin are brought evenly into apposition without the vestige of a stitch in sight. A layer of collodion completes the closure.

So far as I have been able to learn very little has been written upon this subject. At the late International Congress, Professor Vulliet contributed a paper upon the use of the Iodolised silk buried suture in perineorrhaphy. Thus prepared he claims they are innocuous and efficient. Silk can undoubtedly be made aseptic, but it is much more likely to prove an irritant than the tendon suture, and at the most is encysted, while the gut or tendon suture is replaced by connective tissue cells and there follows a living band in place of the fibres of the suture. It is evident, in most conditions, where sutures are required, if this can be attained, a great gain results. The possibilities of the buried suture are all dependent upon the

great fundamental principles of aseptic surgery which must be observed with the strictest accuracy. The material used must be reliable. I have for years, as a rule, prepared my own sutures, after Mr. Lister's formula, obtaining tendons directly from the hunters in Australia. Last year, in order to economize my rapidly diminishing stock of tendons, I used catgut, imported in the original bottles from a reliable English house, which appeared of excellent quality. In a series of operations performed within a few days, were two hysterectomies for the removal of large myomas. In each instance I sewed the uterine stump and closed the peritoneum with sutures from my former supply of tendon, but joined the recti with the English gut. In both cases, pus formed in the line of the gut suture, one recovered slowly with multiple local abscess in the thick abdominal wall; the second died the thirteenth day from systemic poisoning following a well marked lymphangitis. In neither was the abdominal cavity involved. One Alexander operation and one or two minor cases were also followed by supuration which seemed attributable to the gut.

In all continuous suturing, emphasis should be made not to draw the thread tight, remembering that it is *apposition* not *constriction* sought. The blood supply must be lessened as little as possible. This is diminished at the best by the multiple cuts of the needle and must not be added to by ligation of the enclosed parts. Within a few hours cell proliferation supervenes and the sutures should lie at rest in the tissues.

Perhaps there is no better test of the aseptic skill of the operator than in the introduction of the suture. The greatest care should be used that the thread does not become contaminated by touching septic parts. In the perineum this is especially difficult.

The parts should be surrounded by towels wet in sublimate and the irrigation be constant. Septic material on the suture may be deeply implanted into the tissues and most dangerous infection follow. This should be emphasized all the more since it seems almost the only objection which can be raised against the method and in incompetent hands may result in the most serious outcome. To restore the tissues, layer by layer, to their original continuity seems the highest perfection of the end sought. As in fractures of the osseous structures, restoration, fixation, and rest are the factors upon which the resultant depend; a truth to be equally emphasized in aseptic wounds.

